



Formulation And Evaluation Of Immunity Booster Herbal Syrup

Mr.Pratik Datta Handke¹, Dr.Swati S. Rawat², Dr.Sunil S.Jaybhaye³, Mr.Avinash D.Hatkar⁴,
Ms.Sakshi O.Jaju⁵

¹Student of Bachelor of pharmacy,Institute of Pharmacy,Badnapur,Dist.Jalna

² Faculty of Pharmaceutical science,Institute of Pharmacy,Badnapur,Dist.Jalna

³ Faculty of Pharmaceutical science,Institute of Pharmacy,Badnapur,Dist.Jalna

⁴ Faculty of Pharmaceutical science,Institute of Pharmacy,Badnapur,Dist.Jalna

⁵ Faculty of Pharmaceutical science,Institute of Pharmacy,Badnapur,Dist.Jalna

1. ABSTRACT

The increasing global focus on preventive healthcare has led to a resurgence of interest in herbal remedies that enhance immune function. This study involves the formulation and evaluation of an immunity booster herbal syrup using natural ingredients known for their immunomodulatory, antioxidant, and antimicrobial properties. The syrup comprises *Moringa oleifera*, ginger (*Zingiber officinale*), cinnamon (*Cinnamomum verum*), turmeric (*Curcuma longa*), clove (*Syzygium aromaticum*), black pepper (*Piper nigrum*), and jaggery as a natural sweetener. These ingredients have been individually reported to possess significant pharmacological properties beneficial to the immune system. For instance, *Moringa oleifera* is rich in essential vitamins and antioxidants that support immune regulation. Ginger and turmeric exhibit potent anti-inflammatory and antiviral activities, while cinnamon and clove contribute antimicrobial and antioxidant benefits. Black pepper enhances the bioavailability of curcumin from turmeric, thus improving therapeutic efficacy. Jaggery, besides improving palatability, provides essential micronutrients. The final formulation offers a synergistic blend designed to boost immune function naturally. Preliminary observations suggest the syrup is palatable, stable, and potentially effective in enhancing general immunity, warranting further in-vivo studies^[1-6]

2. **KEY WORDS** :- Immunity booster ,antimicrobial , antioxidant

3. INTRODUCTION

Herbal syrup it is defined as a prepared and combination and concentration decoction with Honey sugar or either some time use alcohol. The base of such syrup is a strong herbal

decoction and mixing a decoction with jaggery help to thicken preserves the decoction.[7] Herbal plant and formulation are used for many types of disease like cough syrup and other disease. The cough syrup many types of herbal plant are used for pudina, Tulsi, Cinnamon, honey in that whole plant are used for making herbal medicine the many years. Herbal formulation a most commonly used a development as well as developing countries as health care.

The immune system is one of the most intricate biological systems in the body. It is an intricate network of specialty cells, organs, proteins, and substances. It is critical for giving protection against a range of pathogens, such as bacteria, viruses, and fungi, as well as malignant cells. Host immunity is generally understood to consist of both innate (non-specific) and adaptive (specific) immunity. An organism is more susceptible to infections when its immune system is compromised. These infections can lead to the development of diseases like inflammatory bowel disease, rheumatoid arthritis, and allergy disorders. Unprocessed or naturally occurring plant foods, which may or may not contain bioactive components, are the basis for plant-based functional foods.^[8-14]

SARS-CoV-2, often known as the corona virus, was the cause of a global pandemic. It was initially discovered in Wuhan, China, in December 2019, and at that time, it had infected a large number of people. Cause global disease and death It spreads from person to person and causes fever, sneezing, and coughing fits as a result of respiratory infections. The coronavirus can seriously harm individuals with weakened immune systems. The middle age range, which spans from 40 to 60 years old, is when the aging process began. This results in a decline in the immune system's ability to operate, making people more vulnerable to viruses. Many home remedies were used to maintain a strong immune system in order to combat the corona virus Lots and lots of spices^[15].

Immunological memory does not exist in the immune system's fundamental reaction, but if an antigen is encountered repeatedly in the future, the immune system is likely to remember it and create "memories" of it. An earlier delay occurs in the first antigen-best responses when in touch, and either pathogen-dependent or pathogen-specific adaptive immune function Both innate immunity and adaptive immunity are thought of as identical defense mechanisms that enhance one another, with variations in either system, leading to host reactivity. The immune system is a complicated and multifaceted system that is essential to the body's defense against illnesses and infections.^[16]

The consumption of traditional herbal medicine in those days, are now pursuing their interest by familiarizing themselves with traditional herbal products for the treatment of a range of health issues in diverse local, national, and international contexts (WHO) [7]. Undoubtedly, a significant increase in the last ten years has been seen by some skeptics^[17] in the public's interest in and acceptance of natural remedies for practical use in both industrialized and developing nations.^[18]

Due to this, herbal treatments are now available in syrup storage in preparation for commercialization, in addition to drug storage. Additionally, it has been meticulously and carefully estimated that up to four billion people, or 80% of the world's population, who live in poorer nations depend on herbal remedies.^[19-20]

2.1 Types of immuno boosters :

Substances known as immunoboosters are used for improving the immune system, which aids the body's defense against illnesses and infections. There are numerovarieties of immunoboosters on the market. Including:

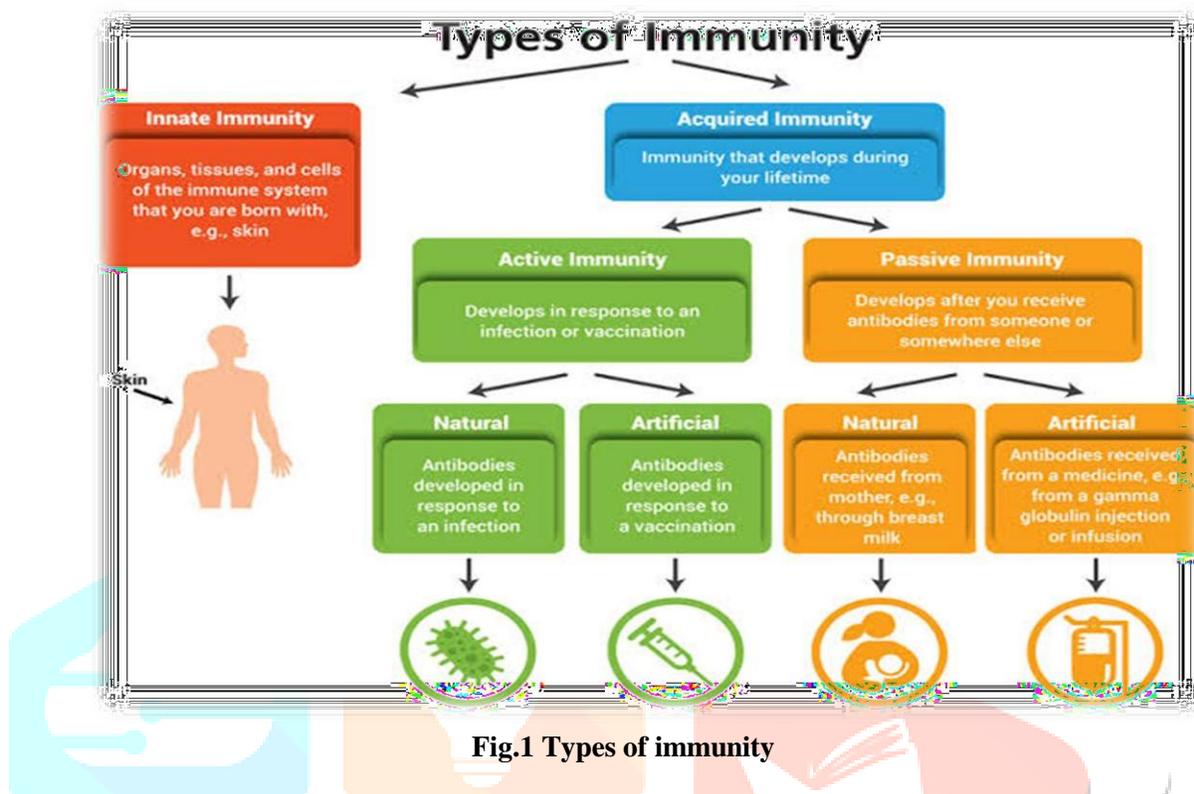


Fig.1 Types of immunity

- **Natural substances:** Herbs, minerals, and vitamins are frequently utilized as organic immunoboosters. They support the healthy and effective operation of the immune system. For instance, vitamin C aids in promoting the development of white blood cells, the body's basic line of defense against infections. Zinc aids white blood cells in their defense against harmful viruses and bacteria, which make it crucial for immune system, function as well. Herbs with antiviral and antibacterial qualities, such as garlic and echinacea, are thought to aid the body in fighting off infections.
- **Vaccines:** A particular class of Immunoboosters has known as vaccines functions by injecting a small quantity of the pathogen into the body. This boosts the production of antibodies by the immune system to recognize and fight the disease- causing agent itself in the future. Immunizations have proven to be very successful in stopping the spread of infectious illnesses like COVID-19, polio, and measles.
- **Medications:** The term "immune modulators" refers to drugs that control immune system function. Diseases like cancer, autoimmune conditions, and chronic infections can all be treated using them. By strengthening the immune system's response, interferon, for instance, is a drug used to treat specific cancers and viral infections. Rheumatoid arthritis and other autoimmune diseases can be treated with interleukins, another class of immunomodulator.
- **Lifestyle changes:** Some aspects of one's lifestyle may improve the immune system. This includes eating a balanced diet, managing stress, exercising frequently, and getting adequate sleep. Sleep is essential for the body's ability to heal and recover cells, especially immune cells. By enhancing blood flow and lowering inflammation, exercise can also aid in enhancing immune function. Stress can impair immunity and increase susceptibility to infections, so it's critical to manage it. Last but not least, maintaining a nutritious diet rich in

fruits, vegetables, and whole grains can give the body the building blocks it requires to maintain immune function.

2.2 Need of Herbal Syrup

The increasing global preference for natural and holistic healthcare has brought herbal syrups into focus as an effective alternative to synthetic medicines. Herbal syrups provide a convenient and palatable form of delivering therapeutic plant extracts, making them particularly suitable for children and the elderly. They also offer rapid absorption of active compounds and can be tailored to address specific health concerns such as immunity enhancement, respiratory relief, and digestive support.^[21-22]

Herbal ingredients such as Moringa oleifera, Ginger (*Zingiber officinale*), Cinnamon (*Cinnamomum verum*), Turmeric (*Curcuma longa*), Clove (*Syzygium aromaticum*), Black Pepper (*Piper nigrum*), and Jaggery are rich in bioactive compounds with proven pharmacological activities. These herbs possess antioxidant, anti-inflammatory, antimicrobial, and immunomodulatory properties, which contribute to overall health and disease prevention.^[23-24]

In light of rising antimicrobial resistance and the adverse effects of synthetic drugs, herbal syrups stand out as safe and effective alternatives. According to the World Health Organization (WHO), approximately 80% of the world's population relies on traditional medicine, including plant-based therapies, for primary healthcare needs (WHO, 2013). Furthermore, scientific studies have begun to substantiate traditional uses of these herbs, confirming their efficacy and safety in health promotion.

2.3 Advantages of herbal syrup

1. Natural and Safe Ingredients:

Herbal syrups are primarily composed of plant-based ingredients, which are generally considered safer and cause fewer side effects compared to synthetic drugs.

2. Immunomodulatory and Therapeutic Properties:

Many herbal ingredients such as Moringa oleifera, Turmeric, Ginger, and Black Pepper are rich in antioxidants and bioactive compounds that enhance immunity, reduce inflammation, and support overall health.

3. Palatable and Easy to Administer:

The syrup form is especially suitable for children, elderly patients, and individuals who have difficulty swallowing tablets or capsules. The addition of natural sweeteners like jaggery improves taste and compliance.

4. Synergistic Action:

A combination of herbs often results in a synergistic effect, enhancing the overall therapeutic efficacy of the formulation.

5. Holistic Approach:

Herbal syrups often provide multi-system benefits, addressing not just symptoms but supporting overall wellness through natural means.

6. Minimal Drug Resistance Risk:

Unlike synthetic antibiotics, herbal ingredients generally do not lead to microbial resistance, making them effective for long-term use.

2.4 Disadvantages of herbal syrup

1. Lack of Standardization:

The concentration of active compounds in herbal preparations can vary significantly, leading to inconsistent therapeutic effects.

2. Slower Onset of Action:

Herbal syrups may take longer to show results compared to conventional medicines, especially in acute conditions.

3. Short Shelf Life :

Liquid herbal formulations often have shorter shelf lives than tablets or capsules due to microbial contamination risks and ingredient degradation.

4. Possible Allergic Reactions or Interactions:

Though natural, some herbs may cause allergic reactions or interact with conventional medications, especially if used without proper guidance.

5. Limited Scientific Evidence:

While traditional knowledge supports the use of many herbs, some formulations lack rigorous clinical trials or standardized pharmacological validation.

6. Storage and Stability Issues:

Herbal syrups require proper storage conditions to prevent spoilage, especially in humid or warm climates.

2.5 Use of herbal syrup

- Immune system support
- Relief from respiratory disorders
- Digestive Aid
- Anti-inflammatory and antioxidant effects
- General health and nutritional support
- Pediatric and geriatric care
- Complimentary use with allopathic medicines

4. AIM AND OBJECTIVES

3.1 *Aim* : Formulation and Evaluation of Immunity Booster Herbal Syrup

3.2 *Objectives*:

- To formulate a herbal syrup using *Moringa oleifera* and other immunity-boosting ingredients.
- To evaluate the syrup's physicochemical properties and stability.
- To assess the syrup's microbiological safety.
- To enhance the syrup's palatability and nutritional value using jaggery.
- To develop a natural, effective, and safe immune-supporting formulation.

3.3 *Herbal Products as syrup*

A. *Moringa Oleifera*

- **Scientific Name:** *Moringa oleifera* Lam
- **Family:** Moringaceae.
- **Order:** Brassicales
- **Genus:** *Moringa*
- **Species:** *Oleifera*
- **Biological Source:** Dried leaves, roots, seeds, and pods obtained from *Moringa oleifera* plant.
- **Chemical Constituents:**
 1. Vitamins:
 - Vitamin A (Beta-carotene)
 - Vitamin C (Ascorbic acid)
 - Vitamin E
 - B-complex vitamins (B1, B2, B3, B6)
 2. Minerals:
 - Calcium, Iron, Potassium, Magnesium, Zinc
 3. Phytochemicals:
 - Flavonoids (Quercetin, Kaempferol)
 - Phenolic acids
 - Tannins
 - Alkaloids
 - Glucosinolates and Isothiocyanates
 4. Proteins and Amino Acids:
 - Contains all 9 essential amino acids
 - Rich in plant protein

5. Fatty Acids (in seeds):

- Oleic acid
- Palmitic acid
- Linoleic acid ^[25]

- **Pharmacological Actions:**

- Immunomodulatory
- Antioxidant
- Anti-inflammatory
- Antidiabetic
- Antimicrobial
- Antihypertensive
- Nutritional supplements



Fig.2 Moringa Oleifera

B. Ginger

- **Scientific Name:** Zingiber officinale Roscoe
- **Family:** Zingiberaceae
- **Order:** Zingiberales
- **Genus:** Zingiber
- **Species:** officinale
- **Biological Source:** Ginger consists of rhizomes of Zingiber officinale
- **Discription:**

As an essential ingredient for a variety of foods and drinks, ginger, which is the rhizome of *Zingiber officinale*, is one of the most commonly utilized species of the ginger family (*Zingiberaceae*). For illnesses including headaches, nausea, rheumatism, and colds, ginger has been used medicinally for over 2500 years in China and India. It is cultivated in the Caribbean Islands, Africa, Australia, Taiwan, and India, although it is thought to be native to Southeast Asia^[26-31]

- **Active constituents:**

There are several strong components and active components in ginger. Ginger oil, which is mostly composed of zingiberene and other sesquiterpene hydrocarbons, is obtained by steam distilling powdered ginger. Studies on the lipophilic rhizome extracts of ginger have identified the principal pungent

compounds, which have resulted in potentially active gingerols that can be further processed into shogaols, zingerone, and paradol. Its distinct flavor appears to be attributed to the compound 6- gingerol. Fresh ginger contains trace amounts of gingerone and shogaols, whereas dried or extracted products contain higher concentrations of these compounds.

- **Pharmacological Actions:**

- Anti-inflammatory

- Antioxidant
- Anti-emetic
- Antimicrobial
- Digestive stimulant
- Hypolipidemic
- Anti-cancer



Fig.3 Ginger

C. Clove :

- **Scientific Name:** *Syzygium aromaticum* (L.) Merr. & L.M. Perry
- **Family:** Myrtaceae
- **Order:** Myrtales
- **Genus:** *Syzygium*
- **Species:** *Aromaticum*
- **Biological Source:** The dried flower buds of *Syzygium aromaticum*.
- **Discription:**

Clove is the dried flower bud of the evergreen tree *Syzygium aromaticum*, belonging to the Myrtaceae family. Native to the Maluku Islands (Indonesia), clove is widely cultivated in tropical and subtropical regions including India, Sri Lanka, Madagascar, and Zanzibar^[32]

- **Active constituents:**

Clove (*Syzygium aromaticum*), a widely used spice and traditional remedy, contains a rich profile of bioactive compounds that contribute to its therapeutic efficacy. The primary active constituent is eugenol, a phenolic compound known for its potent antimicrobial, antioxidant, anti- inflammatory, and analgesic activities.

- **Pharmacological Actions:**

- Antiseptic and wound healing properties
- Carminative and digestive effects
- Pain relieving effect
- Anti-inflammatory
- Hepatoprotective action



Fig.4 Clove

D. Cinnamon :

- **Scientific Name:** Cinnamomum verum J. Presl (also known as Cinnamomum zeylanicum)

- **Family:** Lauraceae

- **Order:** Laurales

- **Genus:** Cinnamomum

- **Species:** verum

- **Biological Source:** The dried inner bark of the tree Cinnamomum verum, belonging to the family Lauraceae.

- **Discription:**

Cinnamon is the dried inner bark of the tree Cinnamomum verum (syn. Cinnamomum zeylanicum), belonging to the Lauraceae family. It is a small, evergreen tree native to Sri Lanka and parts of southern India, and it is now widely cultivated in tropical regions. Cinnamon has a sweet, warm, and woody aroma with a slightly pungent taste. It is used extensively as a spice, flavoring agent, and in traditional medicine for its digestive, antimicrobial, antioxidant, and anti-inflammatory properties. The primary active compound, cinnamaldehyde, gives cinnamon its characteristic flavor and many of its health benefits.

- **Active constituents:**

The primary components of cinnamon are its essential oil, which contains the compounds cinnamaldehyde and trans-cinnamaldehyde (Cin), which give cinnamon its scent and different pharmacological effects. Research has shown that cinnamon extracts, essential oils, and their constituents can inhibit bacteria through a variety of mechanisms, including lipid profile modification, cell division inhibition, ATPase inhibition, membrane porin inhibition, motility inhibition, biofilm formation, and anti-quorum sensing properties.^[33-35]

- **Pharmacological Actions:**

- Antioxidant
- Anti-inflammatory
- Antidiabetic
- Antimicrobial
- Digestive stimulant



Fig.5 Cinnamon

E. Turmeric:

- **Scientific Name:** Curcuma longa L.
- **Family:** Zingiberaceae
- **Order:** Zingiberales
- **Genus:** Curcuma
- **Species:** longa
- **Biological Source:** Dried rhizomes of the plant Curcuma longa, belonging to the Zingiberaceae family.
- **Discription:**

The three to five-foot-tall turmeric plant has yellow flowers that look like funnels and oblong, pointed leaves with short stems. Asia, India, China, and other tropical nations thoroughly grow a precious moneymaker known as turmeric rhizome. Turmeric is frequently used as a food additive, spice for curries, and nutritional pigment^[36-41]

- **Active constituents:**

The polyphenol compound curcumin (diferuloylmethane), which gives turmeric its sharp yellow color, is considered to be the main pharmacological ingredient. Turmeric includes the curcuminoids atlantone, bisdemethoxycurcumin, demethoxycurcumin, diarylheptanoids, and turmerone in along with curcumin.

- **Pharmacological Actions:**

- Antioxidant
- Anti-inflammatory
- Wound healing
- Anti-cancer
- Hepatoprotective
- Antimicrobial



Fig.6 Turmeric

F. Black pepper:

- **Scientific Name:** Piper nigrum L.
- **Family:** Piperaceae
- **Order:** Piperales
- **Genus:** Piper
- **Species:** nigrum
- **Biological Source:** Dried, unripe berries (fruits) of the plant Piper nigrum, belonging to the family

Piperaceae.

● **Discription:**

Clove oil is a volatile essential oil extracted from the flower buds, leaves, or stems of the clove tree (*Syzygium aromaticum*), a species native to the Maluku Islands (the Spice Islands) in Indonesia. It is known for its strong aroma, spicy flavor, and medicinal properties.

The main active compound in clove oil is eugenol (up to 85–90%), which gives the oil its distinct aroma and therapeutic effects.

● **Active constituents:**

Turmeric is a pharmacologically rich plant, and its therapeutic efficacy is attributed to the presence of several active phytoconstituents, primarily curcuminoids and essential oils. These constituents are responsible for turmeric's antioxidant, anti-inflammatory, antimicrobial, and immunomodulatory activities. Piperine is hypothesized to function by boosting the flow of blood to the digestive system, which in turn encourages the active transfer of nutrients. Its ability to enhance absorption through a precise mechanism is not entirely known. Very quickly, piperine crosses the intestinal barrier^[42-45]

● **Pharmacological Actions:**

- Bioavailability Enhancer
- Antioxidant
- Anti-inflammatory
- Digestive stimulant
- Antimicrobial
- Anti-cancer



Fig.7 Black Pepper

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6. MATERIAL AND METHODS

6.1 Requirements:

1. **Ingredients:** 1. Moringa Oleifera,

2. Ginger
3. Turmeric
4. Cinnamon
5. Clove
6. Black Pepper
7. Jaggery.

2. **Apparatus:** 1. Beaker,

2. Test Tube
3. Measuring Cylinder
4. Pipette
5. Water Bath
6. Tripod Stand,
7. Stirrer
8. Mortar & Pestle.

6.2 Formulation

<i>Sr.No</i>	<i>Ingredients</i>	<i>Quantity</i>	<i>Uses</i>
01	Moringa Oleifera	02 gm	Immunity booster
02	Cinnamon	01gm	Antibacterial
03	Clove	0.25 gm	Analgesics
04	Ginger	01 gm	Relieve Cough
05	Black Paper	0.5 gm	Antimicrobial
06	Jaggary	10 gm	Sweetner
07	Termaric	1 gm	Anti-inflammatory
08	Distilled water	q.s.	Vehicle
09	Perfume	q.s.	Tastemask

6.3 Procedure of Herbal Syrup ;

Step 1 : Preparation of moringa oleifera extract (aqueous decoction method)

1. Crush 10 g of dried moringa oleifera leaves to increase surface area.
2. Place the powder in a beaker or stainless-steel saucepan.
3. Add 70 mL of distilled water.
4. Boil gently for 15–20 minutes, allowing the water to reduce and extract the active compounds.
5. Cool the extract and filter it using muslin cloth or filter paper.

Step 2 : Formulation of Herbal Syrup

Take 10 ml of distilled water

Add 10 gm jaggery in it

Boil the mixture till jaggery get dissolve in water

Then add other ingredients in another beaker

Boil the mixture for 20-25 minutes

Cool the mixture and filter it through filter paper

Then add 5ml of moringa solution

Mix gently jaggery water in it with continuous stirring Put syrup in bottle

Store in cool and dry place

7. EVALUATION TESTS OF HERBAL SYRUP

7.1 Organoleptic Evaluation:

evaluated to ensure consumer acceptability and uniformity of the formulation.

1. Colour: Brownish
2. Odour: Pleasant or aromatic
3. Taste: Sweet with mildly spicy undertone

7.2 Physiochemical Evaluation:

The pH meter was calibrated with the help of standard buffer solutions weight 1 ml of herbal syrup and 50 ml of distilled water and its pH was measured with the help of digital pH meter.

- pH: 5.2

7.3 Viscosity:

Viscosity of the herbal syrup was determined with the help of digital viscometer. It found to be 180cps.

7.4 Microbial Evaluation

Microbial tests were performed using standard plate count and selective media techniques.

7.5 Stability testing (30 days at room temperature) : No change in pH and, odour, taste and appearance No microbial growth observed.

7.6 Preliminary Physiochemical screening

1. Alkaloid are present
2. Flavonoids are present
3. Tannins are present

8. RESULT AND DISCUSSION:

The syrup exhibited a brownish-yellow color with a pleasant, aromatic odor attributed to the synergistic blend of ginger, cinnamon, clove, and turmeric. The taste was sweet, derived from jaggery, with mild spicy notes contributed by ginger and black pepper. The syrup had a thick, viscous consistency, which is desirable for throat-coating action and enhanced mucosal absorption.

Acceptable organoleptic properties are crucial for patient compliance. The syrup's appealing taste and smell support its suitability for both children and adults. The uniform appearance and absence of particulate matter also suggest good quality control during the formulation process.

The pH value of 5.2 is within the desirable range for herbal syrups, providing sufficient acidity to inhibit microbial growth while being non-irritant to the throat. The viscosity of 180 cps ensures ease of pouring and consumption, while also allowing the syrup to coat the throat, offering symptomatic relief in immune-compromised or cold-related conditions. The specific gravity and total solids indicate appropriate concentration of active constituents, especially from jaggery and decocted herbs, contributing to both efficacy and shelf life.

Clarity is a visual indicator of formulation integrity. A clear syrup confirms effective filtration and the absence of microbial or particulate contamination. It also enhances consumer trust and acceptability.

The presence of bioactive compounds confirms the pharmacological potential of the formulation. Flavonoids, phenolics, and tannins contribute to antioxidant and anti-inflammatory effects, enhancing immune defense. Alkaloids and saponins may offer additional antimicrobial and immune-stimulating activities. Black pepper enhances the bioavailability of curcumin (from turmeric), increasing systemic absorption and therapeutic effect.

Over 30 days, the syrup remained stable in terms of appearance, odor, and microbial safety. A slight decrease in pH was observed but remained within acceptable limits. This indicates the formulation is chemically and microbiologically stable for at least one month under normal storage conditions, though extended studies are recommended for shelf-life determination^[1-6]

9. CONCLUSION:

In summary, as our immune systems are crucial in protecting our bodies from disease, maintaining a good immune system is critical to our overall health. Keeping yourself healthy and living a healthy lifestyle might help strengthen your immune system. Even though there are allopathic drugs that can combat oxidative stress and increase immunity, it's important to explore alternatives because of these drugs' expensive side effects. Ayurvedic medications have a potential future in natural medicinal development. It is anticipated that the primary component of an immune modulator medication that is safe, effective, and reasonably priced will be herbs. Because of the COVID-19 pandemic, humanity as a whole is suffering.

10. SUMMARY:

The present study was aimed at the formulation and evaluation of a polyherbal syrup composed of *Moringa oleifera*, ginger, turmeric, cinnamon, black pepper, clove, and jaggery, designed to function as a natural immunity booster. Each ingredient was selected based on its traditional and scientifically validated immunomodulatory, antioxidant, and antimicrobial properties.

The syrup was prepared using aqueous extraction of the herbal ingredients, sweetened with jaggery, and preserved naturally. It was subjected to various evaluation parameters to assess its quality and effectiveness. The syrup demonstrated excellent organoleptic properties—having a pleasant taste, aroma, and appearance—which support patient acceptability.

Physicochemical testing revealed a pH of 5.2, suitable viscosity (180 cps), and a high total solids content (62%), ensuring stability and efficacy. Clarity was confirmed with no visible particles or turbidity. Microbial testing showed that the syrup was free from harmful pathogens (*E. coli*, *Salmonella*, *Staphylococcus aureus*) and met WHO standards for microbial load.

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